



**DEPARTMENT of AGRICULTURE
and NATURAL RESOURCES**

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**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 8652-3, John G Yaggie**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Agriculture and Natural Resources concerning Water Permit Application No. 8652-3, John G Yaggie, 901 E 17th Street, Yankton SD 57078.

The Chief Engineer is recommending APPROVAL of Application No. 8652-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing domestic water uses and water rights, 3) the proposed use is a beneficial use and 4) it is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board with the following qualifications:

1. The wells approved under Water Permit Nos. 6939-3, 7194-3, 7417-3 and 8652-3 are located near domestic wells and other wells which may obtain water from the same aquifer. Water withdrawals shall be controlled so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
2. This Permit is approved subject to the irrigation water use questionnaire being submitted each year.

See report on application for additional information.

Eric Gronlund, Chief Engineer
October 7, 2022

Report to the Chief Engineer
On Water Permit Application No. 8652-3

John G Yaggie

October 12, 2022

Water Permit Application No. 8652-3 proposes to irrigate 14 acres. The applicant holds Water Permit Nos. 6939-3, 7194-3, and 7417-3 which collectively authorize a maximum instantaneous diversion rate of 4.44 cubic feet of water per second (cfs) from two existing wells completed into the Missouri: Elk Point aquifer (110 feet deep) located in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 11 and near the center of Section 12 for the irrigation of 248 acres located in the S $\frac{1}{2}$ NE $\frac{1}{4}$, SE $\frac{1}{4}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 11 and S $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ NE $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 12; all in T93N-R55W. A licensing investigation found the systems irrigating an additional 14 acres located within the area described above which is located in Yankton County approximately two miles southwest of Mission Hill, SD.

If approved, Water Permit Application No. 8652-3 and Water Permit Nos. 6939-3, 7194-3, and 7417-3 will collectively authorize a maximum instantaneous diversion rate of 4.44 cfs from two existing wells completed into the Missouri: Elk Point aquifer (110 feet deep) for the irrigation of 262 acres to reflect the irrigation systems as developed.

AQUIFER: Missouri: Elk Point (M: EP)

HYDROGEOLOGY:

The Missouri: Elk Point aquifer is a glacial deposit outwash consisting of fine sand to very coarse gravel (Niehus, 1997). The Missouri: Elk Point aquifer underlies approximately 219,100 acres in Clay, Union, and Yankton Counties in South Dakota, and the aquifer contains approximately 3,287,100 acre-feet of recoverable water in storage (Hedges et al., 1982). The Missouri: Elk Point aquifer is hydraulically connected to the Lower Vermillion Missouri and Lower James Missouri aquifers, and the Big Sioux, James, Missouri, and Vermillion Rivers (Niehus, 1994; Stephens, 1967).

The Missouri: Elk Point aquifer is generally under confined conditions in the northwestern part of the aquifer, and generally under unconfined conditions in the southern part of the aquifer, and the direction of groundwater movement in the aquifer is generally from the northwest to the southeast (Niehus, 1994 and 1997).

There are water well completion reports on file for the existing wells proposed to be used by Water Permit Application No. 8652-3 and authorized by Water Permit Nos. 6939-3 and 7194-3 (Water Rights, 2022c and 2022d). The first report lists, "brown clay" from 0 to 9 feet, "coarse sand" from 9 to 30 feet, "med sand/med gravel" from 30 to 108 feet, and "rocks" from 108 to 110 feet (Water Rights, 2022d). The well was screened from 70 to 110 feet below the ground surface and had a static water level of approximately 20 feet at the time of well completion (May 5, 2008) (Water Rights, 2022d). The second report lists, "topsoil" from 0 to 4 feet, "med sand" from 4 to 10 feet, "brown clay" from 10 to 25 feet, "coarse sand/med gravel" from 25 to 90 feet,

“grey clay” from 90 to 98 feet, and “coarse gravel & rocks” from 98 to 108 feet (Water Rights, 2022d). The well was screened from 48 to 108 feet below the ground surface and had a static water level of approximately 19 feet at the time of well completion (April 29, 2010) (Water Rights, 2022d). Based on the well completion reports on file for the existing wells proposed to be used, and the well competition reports and lithologic logs on file for nearby observation wells, the Missouri: Elk Point Aquifer is unconfined at the existing well sites (SDGS, 2022; Water Rights, 2022b and 2022d).

Figure 1 displays a map of the approximate Missouri: Elk Point aquifer boundary (modified from Hedges et al., 1982) and the location of the existing wells proposed to be used by Water Permit Application No. 8652-3 (Water Rights, 2022c).

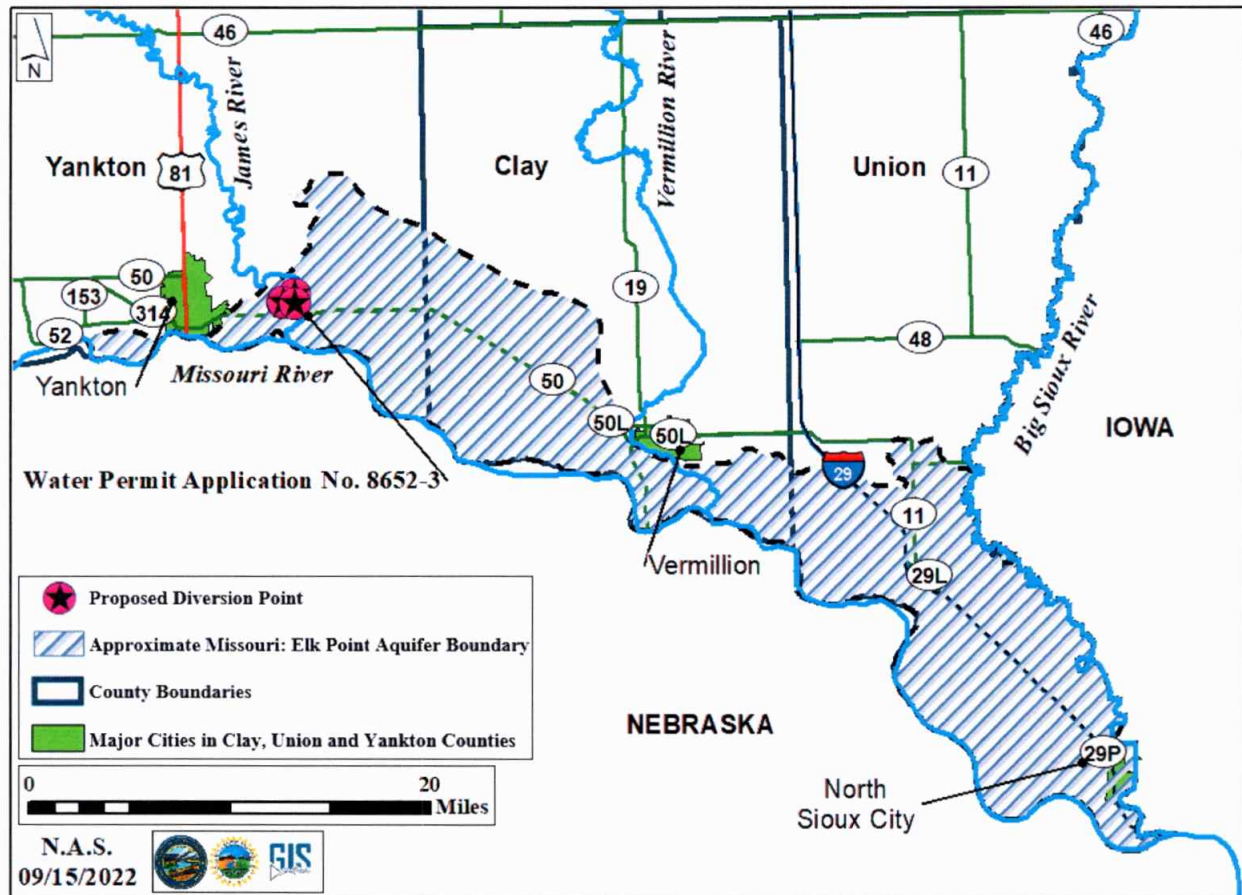


Figure 1. Map of the approximate Missouri: Elk Point aquifer boundary modified from Hedges and others (1982) with the location of the existing wells proposed to be used by Water Permit Application No. 8652-3 (Water Rights, 2022c)

South Dakota Codified Law (SDCL) 46-2A-9

Pursuant to SDCL 46-2A-9, “A permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant’s proposed use, that the diversion point can be developed without unlawful impairment of existing domestic water uses and water rights, and that the proposed use is a beneficial use and in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board as defined by SDCL 46-2-9 and 46-2-11.” This report will address the availability of unappropriated water and the potential for unlawful impairment of existing domestic water uses and water rights within the Missouri: Elk Point aquifer.

WATER AVAILABILITY:

Water Permit Application No. 8652-3 proposes to appropriate water from the Missouri: Elk Point aquifer. The probability of unappropriated water being available from the aquifer can be evaluated by considering SDCL 46-6-3.1, which requires “No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source. An application may be approved, however, for withdrawals of groundwater from any groundwater formation older than or stratigraphically lower than the greenhorn formation in excess of the average estimated annual recharge for use by water distribution systems.” The Missouri: Elk Point aquifer is not older than or stratigraphically lower than the Greenhorn Formation (Fahrenbach et al., 2010), and the applicant’s proposed use is not for use in a water distribution system as defined by SDCL 46-1-6(17). Therefore, the average annual recharge and average annual withdrawal rates to and from the Missouri: Elk Point aquifer must be considered.

HYDROLOGIC BUDGET:

Recharge

Recharge to the Missouri: Elk Point aquifer is primarily through the infiltration of precipitation where the aquifer is at or near the ground surface, seepage from the Big Sioux, James, Missouri, and Vermillion Rivers, inflow from the Lower Vermillion-Missouri aquifer at the northern boundary of the Missouri aquifer and inflow from the Big Sioux aquifer at the extreme northeastern boundary of the Missouri aquifer, and from the underlying Dakota aquifer in Union County (Niehus, 1994 and 1997).

Using observation well analysis, Hedges and others (1985) estimated a recharge rate to the Missouri: Elk Point aquifer of approximately 3.8 inches per year. The Elk Point management unit is estimated to underly approximately 219,100 acres (Hedges et al, 1982); therefore, the average annual recharge rate of the Missouri: Elk Point aquifer is approximately 69,382 acre-feet per year.

Stephens (1967) noted that pumping of the Missouri: Elk Point aquifer will induce recharge from the Missouri River. Stonesifer (2013) estimated that the Missouri River contributed 22,582 acre-feet per year of recharge induced from the pumping operation at Lewis and Clark RWS. This

estimate is based off inducing at least 50% recharge of the water pumped at full development of the existing and future use permits held by Lewis and Clark RWS. Depending on location and diversion rate, this percentage of induced recharge is likely much greater than 50% (Mathiowetz, 2021). This results in a total estimated recharge rate of approximately 92,000 acre-feet per year to the Missouri: Elk Point aquifer. There are other wells, both domestic and appropriative, in close vicinity to the Missouri River that can induce recharge from the river, but that amount of induced recharge has not been quantified.

The South Dakota Geological Survey (SDGS) is currently investigating a study regarding the induced recharge from the Missouri River resulting from the increased development of the Lewis & Clark Regional Water System project. The study is expected to be completed in the Fall of 2022. Preliminary findings of the SDGS report indicate the induced recharge from the Missouri River associated with the pumping by Lewis & Clark Regional Water System will increase the estimated average annual recharge significantly higher than the current estimate of 92,000 acre-feet per year.

Discharge

Discharge from the Missouri: Elk Point aquifer is primarily through well withdrawals, evapotranspiration where the aquifer is at or near the ground surface, outflow to the Big Sioux and Missouri Rivers during periods of low flow and stage, and leakage to the underlying Dakota aquifer (Niehus, 1994 and 1997; Water Rights, 2022c).

Currently, there are 630 water rights/permits authorized to appropriate water from Missouri: Elk Point aquifer, plus three pending applications – Water Permit Application No. 8656-3 requesting to irrigate 143.61 acres in Yankton County, Water Permit Application No. 8660-3 requesting to irrigate 160 acres in Union County (Water Rights, 2022c), and Water Permit Application No. 8614-3, a deferred, pending application applied for by Lewis & Clark Regional Water System, requesting to appropriate up to 8,318 acre-feet per year. The application is currently deferred, awaiting completion of a study by the SDGS regarding the induced recharge from the Missouri River resulting from the increased development of the Lewis & Clark Regional Water System project.

Additionally, there are five future use permits (Nos. 5832-3, 6237-3, 6869-3, 6869A-3, and 7208-3) reserving 1,900 acre-feet of water annually from the Missouri: Elk Point aquifer (Water Rights, 2022c). For the purpose of estimating average annual withdrawals, the future use permits are assumed to be fully developable for a total of 1,900 acre-feet per year.

Table 1 summarizes the 42 non-irrigation water rights/permits (including two irrigation water permits, see paragraph below) authorized to appropriate water from the Missouri: Elk Point aquifer with the estimated annual use for each water right/permit as determined by their limiting diversion rate or annual volume. Historically, average water use by non-irrigation appropriations limited by an instantaneous diversion rate have been assumed to be pumping 60% of full time at the respective permitted diversion rate. Water rights/permits limited by an annual volume are assumed to withdraw their entire respective annual volume limitation. This is a standard method

used by the DANR-Water Rights Program for estimating annual withdrawals by non-irrigation appropriations from an aquifer (Water Rights, 2022c).

Water Permit No. 5998-3 is permitted for turf irrigation and Water Permit No. 5998A-3 extends the amount of time allowed for water to be put to beneficial use as authorized by Water Permit No. 5998-3 (Water Rights, 2022c). The estimated use for these two irrigation permits is included with the non-irrigation water rights/permits listed on Table 1, as the permit holder is not required to submit an annual irrigation questionnaire. However, Water Permit No. 5998-3 is authorized for use in a rural water system and the permit holder reports the estimated use by Water Permit No. 5998-3 with their other rural water system Missouri: Elk Point permits, listed on Table 2 (Water Rights, 2022c).

Three municipal water rights were identified as being connected to a rural water system and likely maintain their wells for standby purposes (Drinking Water Program, 2022; Water Rights, 2022c); as such, the average annual water use for these water rights has been estimated to be zero acre-feet per year on Table 1.

Water Permit No. 7059-3 is permitted for recreational use for maintaining the water level of a small lake with a surface area of 17.6 acres (Water Rights, 2022c). It is assumed that the only consumptive use of this water is due to evaporation (Water Rights, 2022c). Annual evaporation of water from shallow lakes is estimated to be approximately 42 inches per year at the location of the authorized diversion point for Water Permit No. 7059-3 (NOAA, 1982), and average annual total precipitation at the Sioux City, Iowa airport was determined to be approximately 29.27 inches over the 30-year period of record (1991 to 2020) (Arguez et al., 2020), which results in the lake to fluctuate approximately 12.73 inches per year. To maintain the water level of the small lake, the estimated use of Water Permit No. 7059-3 is approximately 18.7 acre-feet per year.

Overall, the average annual withdrawal rate for the 42 non-irrigation water rights/permits (including the two irrigation permits not required to submit an annual irrigation questionnaire) authorized to appropriate water from the Missouri: Elk Point aquifer is approximately 61,338 acre-feet per year (Table 1) (Water Rights, 2022c and 2022f).

Report on Water Permit Application No. 8652-3

Table 1. Estimated annual use for the non-irrigation water rights/permits (plus two irrigation water permits) authorized to divert water from the Missouri: Elk Point aquifer (Drinking Water Program, 2022; Water Rights, 2022c and 2022f)

Permit No.	Name	Status	Priority Date	Use	Authorized Diversion Rate (cfs)	Authorized Annual Volume (acre-feet/year)	Total Estimated Use (acre-feet/year)
4501-3	Eddie Wohl	LC	03/27/1980	COM	0.05		21.7
5616-3	Cimpls Inc	LC	01/31/1992	COM	0.44		191.1
5827-3	Don Lantis	LC	06/08/1994	COM	0.022		9.6
5953-3	H & K Oil Co	LC	08/19/1996	COM	0.037		16.1
6151-3	Vernon & Norma Vakoc	LC	10/04/1999	COM	0.67		291
6580-3	West Shores Acres LLC	LC	01/28/2005	COM	0.10		43.4
8031-3	Dakota Protein Conversion Inc	PE	06/18/2014	COM	0.22		95.6
8147-3	Doug Lafleur	PE	04/06/2015	COM, LCO	1.0	160	162
8381-3	RP Constructors	PE	11/19/2018	COM	0.04	1	1
8403-3	Stockmen's Livestock Inc	PE	06/27/2019	COM	2.0	40	40
8415-3	RC Investments Inc	PE	11/14/2019	COM	0.10	25	25
8435-3	Sioux City Insulation	PE	07/30/2012	COM	0.33	1	1
6744-3	Judith I Grant	PE	07/24/2006	DOM, COM	0.78		338.8
7388-3	Clay RWS Inc	PE	07/30/2012	DOM, IRR	2.0		281
5998-3	Clay RWS Inc	PE	04/21/1997	IRR, DOM	2.2		
5998A-3	Clay RWS Inc	PE	04/21/1997	IRR, DOM	0.0		
5490-3	USGS CERC Field Research Station	LC	11/15/1990	FWP	0.09		39.1
5907-3	US Fish and Wildlife Service	LC	01/26/1996	FWP	3.78		1,642
6733-3	US Fish and Wildlife Service	LC	06/07/2006	FWP	1.11		482.2
7094-3	US Fish and Wildlife Service	LC	12/01/2008	FWP	2.67		1,159.8
5021-3	Vishay-Dale Electronics Inc	LC	05/04/1984	IND	0.10		43.4
5388-3	LG Everist Inc	LC	01/30/1990	IND	0.45		195.5
5453-3	AaLadin Industries Inc	LC	05/24/1990	IND	0.05		21.7
5593-3	Vishay-Dale Electronics Inc	LC	10/31/1991	IND	0.056		24.3
6170-3	Concrete Materials	LC	01/03/2000	IND	0.222		96.4
1255-3	City of Elk Point	LC	01/01/1914	MUN	1.13		490.9
143-3	City of Vermillion	LC	01/21/1956	MUN	1.78		773.2
147-3	City of Vermillion	LC	01/01/1935	MUN	2.66		1,237
6236-3	City of Vermillion	LC	11/06/2000	MUN	2.6	1,161	
6354-3	City of Vermillion	LC	08/12/2002	MUN	0.022		
1965-3	Town of Gayville	LC	01/01/1914	MUN	0.37		0*
4207-3	Town of Jefferson	LC	01/01/1916	MUN	0.90		391
5118-3	Town of Gayville	LC	01/28/1987	MUN	0.33		0*
5437-3	Dakota Dunes Community Improvement District	LC	04/12/1990	MUN	3.33		1,446.6
5782-3	City of North Sioux City	LC	08/12/1993	MUN	1.14		495.2
8212-3	City of Yankton	LC	03/25/2016	MUN	20.12	6,050	6,050
7059-3	WE Investments LLC	PE	08/28/2008	REC	3.11		18.7
6736-3	Lewis and Clark RWS	PE	07/08/1994	RWS	27.85	20,165	45,165
7207-3	Lewis and Clark RWS	PE	07/08/1994	RWS	20	12,000	
8613-3	Lewis and Clark RWS	PE	07/16/2007	WDS	29.8	13,000	
5581-3	Larson's Landing	LC	07/30/1991	SHD	0.089		38.7
5592-3	East Winds Court Inc	LC	10/09/1991	SHD	0.11		0*
						TOTAL:	61,338
*Identified as being connected to a RWS							
COM: Commerical; DOM: Domestic; FWP: Fish and Wildlife Propagation; IND: Industrial; IRR: Irrigation; LCO: Livestock Confinement Operation;							
MUN: Municipal; REC: Recreation; RWS: Rural Water System; SHD: Suburban Housing Development							

The average annual withdrawal rate for the 42 non-irrigation water rights/permits (including the two irrigation permits not required to submit an annual irrigation questionnaire) estimated on Table 1, 61,338 acre-feet per year, takes into consideration the 15 non-irrigation water rights/permits that are required to report their annual usage from the Missouri: Elk Point aquifer (Water Rights, 2022c and 2022f).

Three of the non-irrigation water rights/permits that are required to report (Nos. 8031-3, 8415-3, and 8435-3) are currently under development and have not reported any withdrawals from the Missouri: Elk Point aquifer to the DANR-Water Rights Program (Water Rights, 2022c). The remaining twelve non-irrigation water rights/permits that are required to report their annual usage from the Missouri: Elk Point aquifer are shown on Table 2 (Water Rights, 2022c and 2022f). The reported usage (as shown on Table 2) for Permit Nos. 8381-3 and 8403-3 (approved in 2018 and 2019) is not necessarily reflective of the future usage of these permits based on information within their respective water permit files (Water Rights, 2022c), and only three years of reported withdrawals (Water Rights, 2022f). Therefore, the estimated use for Permit Nos. 8031-3, 8415-3, 8435-3, 8381-3, and 8403-3 will be based on the method used above: water rights/permits limited by an instantaneous diversion rate have been assumed to be pumping 60% of full time at the respective permitted diversion rate; water rights/permits limited by an annual volume are assumed to withdraw their entire respective annual volume limitation. Their estimated average annual withdrawal rate is listed on Table 1.

Next, the reported use for the City of Yankton (8212-3) and Lewis and Clark RWS (6736-3, 7207-3, and 8613-3) (as shown on Table 2) is steadily increasing (Water Rights, 2022f), as these water users are continually undergoing development (Water Rights, 2022c). It is likely these water users will use up to their entire respective annual volume limitation in the future; therefore, the average annual withdrawal rate for these water rights/permits is assumed to be their entire respective annual volume listed on Table 1 (Water Rights, 2022c).

Lastly, the annual withdrawal rate for Clay RWS Inc (Permit Nos. 5998-3, 5998A-3 and 7388-3), Doug Lafleur (8147-3), and City of Vermillion (147-3, 6236-3) on Table 2 are relatively steady over their respective periods of record (Water Rights, 2022c and 2022f); therefore, the average annual withdrawal rate based on the reported values from each of these water users (as shown on Table 2) is reasonably reflective of the future withdrawals likely to be made by these appropriative users. The average annual withdrawal rate based off the reported annual withdrawal rates averaged on Table 2 for these water rights/permits will be used in this analysis.

Table 2. Non-irrigation water rights/permits required to report their respective annual use from the Missouri: Elk Point aquifer (Water Rights, 2022c and 2022f)

	RP Constructors	Stockmen's Livestock Inc	Clay RWS Inc	Doug Lafleur	City of Vermillion	City of Yankton	Lewis and Clark RWS
	8381-3	8403-3	5998-3, 5998A-3, 7388-3	8147-3	147-3, 6236-3	8212-3	6736-3, 7207-3, 8613-3
2003			238		1,363		
2004			483		1,226		
2005			21		1,247		
2006			170		1,252		
2007			217		1,344		0
2008			213		1,199		0
2009			215		1,140		0
2010			183		1,071		0
2011			137		1,127		92
2012			525		1,317		3,836
2013			301		1,183		9,368
2014			307		1,121		11,532
2015			278	202	1,161		15,591
2016			231	202	1,175	66	17,091
2017			276	202	1,215	531	18,051
2018			305	98	1,168	504	18,143
2019	0.0171	1	292	135	1,440	1,370	20,397
2020	0.0224	4.2	461	121	1,373	2,923	21,039
2021	0.2332	5.5	486	170	1,378	3,065	23,537
Max	0.2	5.5	525	202	1,440	3,065	23,537
Min	0.0171	1	21	98	1,071	66	0
Avg	0.091	3.57	281	162	1,237	1,410	14,425*
RWS: Rural Water System *Excluded reported zero values							

Currently, there are 590 irrigation water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer, plus two pending applications – Water Permit Application No. 8656-3 requesting to irrigate 143.61 acres in Yankton County and Water Permit Application No. 8660-3 requesting to irrigate 160 acres in Union County (Water Rights, 2022c). Irrigation water rights/permits have been typically required to report their annual usage on an irrigation questionnaire since 1979. The estimated average annual withdrawal rate for the Missouri: Elk Point aquifer irrigation water rights/permits that have reported over the period of record is approximately 18,503 acre-feet per year (Table 3) (Water Rights, 2022a). To reflect the current development of irrigation water rights/permits more accurately, the average annual withdrawal rate for irrigation appropriations that have reported from 2012 to 2021 is approximately 26,973 acre-feet per year (Table 3) (Water Rights, 2022a).

The usage for two irrigation water permits (Nos. 5998-3 and 5998A-3) was accounted for on Table 1 with the non-irrigation water rights/permits, as the permit holder is not required to submit an annual irrigation questionnaire (Water Rights, 2022c), resulting in only 588 of the Missouri: Elk Point aquifer irrigation water rights/permits being currently required to submit an annual irrigation questionnaire (Water Rights, 2022c).

Table 3 lists only 572 water rights/permits as reporting in 2021 (Water Rights, 2022a and 2022c). The 572 water rights/permits listed as reporting in 2021 includes three water rights/permits (Nos. 3722-3, 7066-3, and 7800-3) that were incorporated into another water right in 2022 (Water Rights, 2022c), resulting in only 569 of the water rights/permits listed as reporting in 2021 being currently active.

Nineteen water permits/rights did not submit an irrigation questionnaire form in 2021 that are currently active, accounting for the difference between the 569 currently active water rights/permits listed as reporting in 2021 and the 588 irrigation water rights/permits currently required to submit an annual irrigation questionnaire (Water Rights, 2022a and 2022c). Of these 19 permits, 16 were issued in 2021 or 2022 and have not submitted an irrigation questionnaire at this time. Of the remaining three water rights (Nos. 3154-3, 4745-3, and 5935-3), Water Right No. 5935-3 is not required to submit an irrigation questionnaire and Water Right Nos. 3154-3 and 4745-3 did not submit an irrigation questionnaire in 2021 for an unknown reason. Overall, these nineteen water permits/rights are authorized to irrigate approximately 1,992 acres. Generally, irrigators in eastern South Dakota apply less than one foot of water per acre per year. However, to account for the fluctuation in wet and dry cycles from year to year, the one foot of water per acre per year application rate will be used to somewhat overestimate the annual withdrawal rate for these irrigation water rights/permits. Therefore, the estimated average annual withdrawal rate for the nineteen irrigation water rights/permits (not included as listed as reporting) is approximately 1,992 acre-feet per year (Water Rights, 2022c). Additionally, the estimated use for the pending applications, Water Permit Application No. 8656-3 requesting to irrigate 143.61 acres and Water Permit Application No. 8660-3 requesting to irrigate 160 acres, is approximately 303.61 acre-feet per year (Water Rights, 2022c).

The collective estimated average annual withdrawal rate for the irrigation appropriations that have reported from 2012 to 2021 (26,973 acre-feet/year) (Table 3), plus the estimated average annual withdrawal rate for the nineteen irrigation water rights/permits (not included as listed as reporting on Table 3) plus two pending applications (2,296 acre-feet/year), is approximately 29,269 acre-feet/year (Water Rights, 2022a and 2022c).

Table 3. Reported historic irrigation use from Missouri: Elk Point aquifer (Water Rights, 2022a)

Year	No. of Permits Reporting	Reported Pumpage (acre-feet)
1979	259	9,859
1980	263	15,045
1981	297	13,096
1982	269	18,822.4
1983	273	10,834
1984	281	9,194.3
1985	282	13,718.5
1986	286	6,252.1
1987	281	13,163.7
1988	282	28,184.6
1989	292	25,651.9
1990	297	19,425
1991	300	18,798.6
1992	295	1,882
1993	298	1,475.2
1994	295	10,221.4
1995	292	18,320.2
1996	296	9,412.8
1997	305	17,182
1998	313	11,127.2
1999	308	14,748
2000	309	26,640.1
2001	313	19,071.9
2002	315	23,547.2
2003	314	26,734.7
2004	322	23,862.3
2005	335	23,964.5
2006	353	27,974.5
2007	366	30,482.8
2008	396	16,261.9
2009	410	6,121
2010	419	2,723.9
2011	431	12,107.6
2012	445	56,538.2
2013	543	34,838.5
2014	557	12,084.2
2015	563	17,751.9
2016	564	27,638.6
2017	567	37,013.5
2018	570	8,855.7
2019	575	8,847.3
2020	570	26,140
2021	572	40,017.1
Min	259	1,475
Max	575	56,538
Avg (1979 to 2020)	369	18,503
Avg (2012 to 2021)	553	26,973

Farmer (2018a) initially utilized an application rate of 0.35 acre-feet per permitted acre to estimate an average annual use from the Missouri: Elk Point aquifer for both crop and turf irrigation water rights/permits. Farmer (2018b) later established that turf irrigation should be estimated separately because turf irrigators tend to utilize their full authorized appropriation (Water Rights, 2022a). Farmer (2021) estimated an application rate of 0.97 feet per year for turf irrigation and 0.343 feet per year for crop irrigation. Currently, there are approximately 82,300 acres authorized to be irrigated from the Missouri: Elk Point aquifer (plus two pending applications - Water Permit Application No. 8656-3 requesting to crop irrigate 143.61 acres and Water Permit Application No. 8660-3 requesting to crop irrigate 160 acres), with approximately 809.6 of those acres authorized for turf irrigation (Water Rights, 2022c). Table 4 contains the turf irrigation permits with their respective authorized permitted acres and an estimated average annual use based on Farmer's (2021) application rate (Water Rights, 2022c).

By applying the application rate of 0.97 feet per year (Farmer, 2021) by the 809.6 acres being turf irrigated (minus the 300 acres authorized by Water Permit Nos. 5998-3 and 5998A-3 – estimated use accounted for on Table 1) (Water Rights, 2022c), the annual use for turf irrigation yields approximately 494.3 acre-feet per year (Table 4).

By applying the application rate of 0.343 feet per year (Farmer, 2021) by the 81,490 (total acres minus turf irrigated acres) acres being crop irrigated (Water Rights, 2022c), plus the pending applications - Water Permit Application No. 8656-3 requesting to crop irrigate 143.6 acres and Water Permit Application No. 8660-3 requesting to crop irrigate 160 acres, the annual use for crop irrigation yields approximately 28,055 acre-feet per year.

Collectively, the average annual use from the Missouri: Elk Point aquifer for both crop and turf irrigation water rights/permits utilizing Farmer's (2021) application rate is approximately 28,549.5 acre-feet per year.

Table 4. Water rights/permits authorized for irrigation of turf (Water Rights, 2022c)

Permit No.	Name	Status	County	Acres	Total Estimated Use (acre-feet/year)
1294-3	Recreation Development Assn. Inc.	LC	Union	102	98.9
2011-3	TR Golf LLC	LC	Union	95	92.2
5786-3	Dakota Dunes Golf Course	LC	Union	173	167.8
5998-3	Clay Rural Water System Inc	PE	Union	300	0*
5998A-3	Clay Rural Water System Inc	PE	Union	0	0*
5935-3	Ted Waitt	LC	Union	1	0.97
5936-3	Applied Engineering	LC	Yankton	1.8	1.7
8010-3	Ryan Rusher	LC	Yankton	2.5	2.4
8029-3	Dakota Dunes Comm Improvement District	PE	Union	17.8	17.3
8040-3	Heine Electric & Irrigation Inc	LC	Clay	1	0.97
8354-3	TR Golf LLC	PE	Union	30	29.1
8407-3	Gayville-Volin School District 63-1	LC	Yankton	4.5	4.4
8530-3	National Field Archery Association Foundation	LC	Yankton	16	15.5
8560-3	TR Golf LLC	PE	Union	65	63.1
			TOTAL:	809.6	494.3

* Volume for this permit holder accounted for on Table 1

There are domestic wells completed into the Missouri: Elk Point aquifer that do not require a water right/permit, so the withdrawal amount from those wells is unknown (Water Rights, 2022d). Due to their relatively low diversion rates, withdrawals from domestic wells are not considered to be a significant portion of the hydrologic budget. Additionally, with the development of rural water systems in areas where the Missouri: Elk Point aquifer is the uppermost aquifer available; it is likely some domestic users may have transitioned to rural water. Therefore, the quantity of water withdrawn by domestic wells is estimated to be negligible to the hydrologic budget for the Missouri: Elk Point aquifer.

Hydrologic Budget Summary

Preliminary findings of the SDGS report indicate the induced recharge from the Missouri River associated with the pumping by Lewis & Clark Regional Water System will increase the estimated average annual recharge significantly higher than the current estimate of 92,000 acre-feet per year; such that, the average annual recharge rate is expected to be greater than the average annual withdrawal rate from the Missouri: Elk Point aquifer and the hydrologic budget is expected to be satisfied.

The average annual withdrawal rate for the water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer totals approximately 100,110 acre-feet per year (including the estimated use for Water Permit Application No. 8652-3, if approved) (listed on Table 5). There is likely more induced recharge than what has been calculated. Based on the hydrologic budget, there is a reasonable probability unappropriated water is available from the Missouri: Elk Point aquifer for the proposed appropriation.

Table 5. Estimated use from Missouri: Elk Point aquifer (Water Rights, 2022a, 2022c, and 2022f)

Type of Water Right/Permit	Estimated Use (acre-feet/year)
Future Use Reservations	1,900
Non-Irrigation	61,338
Deferred Pending Application No. 8614-3	8,318
Irrigation (Farmer's (2021) turf and crop application rates plus pending applications: Nos. 8656-3 and 8660-3)	28,549.5
Application No. 8652-3 (if approved, assuming Farmer's (2021) crop application rate of 0.343 per acre)	4.8
TOTAL:	100,110

OBSERVATION WELL DATA:

Administrative Rule of South Dakota (ARSD) 74:02:05:07 requires that the Water Management Board shall rely upon the record of observation well measurements in addition to other data to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated average annual recharge of the aquifer.

Observation wells provide data on how the aquifer reacts to regional climatic conditions and local pumping. The DANR-Water Rights Program monitors 36 observation wells completed into the Missouri: Elk Point aquifer (Water Rights, 2022b). The five closest observation wells to the wells the applicant proposes to use are YA-57DR (approximately 0.9 miles northeast), YA -79H (approximately 2.0 miles northeast), YA-78J (approximately 3.1 miles northeast), YA-80JA (approximately 5.4 miles northeast), and YA-78F (approximately 6.2 miles northeast) (Water Rights, 2022b). The hydrographs for these observation wells are displayed in Figures 2 to 6 (Water Rights, 2022b). The data points utilized to construct the hydrographs are measurements of the static water level in the observation wells from the top of the well casing. It is worth noting the hydrograph titles display DENR Water Rights Observation Well on the hydrographs when the titles should display DANR Water Rights Observation Well on the hydrographs.

Observation well YA-57DR was completed into the Missouri: Elk Point aquifer in 2020; thus, the period of record for water level readings from the well are limited (as shown on Figure 2) (SDGS, 2022; Water Rights, 2022b). The hydrographs for the observation wells display generally stable water levels over their respective periods of record. The hydrographs for the Missouri: Elk Point aquifer indicate that the aquifer responds well to climatic conditions because water levels are rising during wetter periods (early spring snowmelt and precipitation) and declining to a stable water level during drier periods. Additionally, the water levels in the observation wells display that the amount of recharge to and natural discharge from the aquifer greatly exceeds pumping with the aquifer returning to pre-pumping conditions between irrigation seasons. Aquifer recovery indicates that climatic conditions and therefore, the effects of recharge to and natural discharges from the aquifer govern the long-term fluctuations of waters levels in the aquifer rather than the impacts of pumping from the Missouri: Elk Point aquifer. By recognizing that both recharge to and natural discharge from an aquifer can be captured for pumping, the observation well hydrographs demonstrate unappropriated water is available for the proposed appropriation.

It is worth noting, several Missouri: Elk Point aquifer observation well hydrographs show a gradual downward trend. These observation wells are located near the Missouri River, and the downward trend seen on the hydrographs is due to the entrenchment of the river channel, below Gavins Point Dam (Yankton, SD), that has lowered the water surface elevation of the river (Goodman, 2007). The entrenchment has resulted in a lowering of water levels in the hydraulically connected, Missouri: Elk Point aquifer, as the water level in the aquifer equilibrates to the lower average water surface elevation of the river. Therefore, the downward trends seen on some observation well hydrographs are likely caused by the entrenchment of the Missouri River change, and not from over-appropriation of the Missouri: Elk Point aquifer.

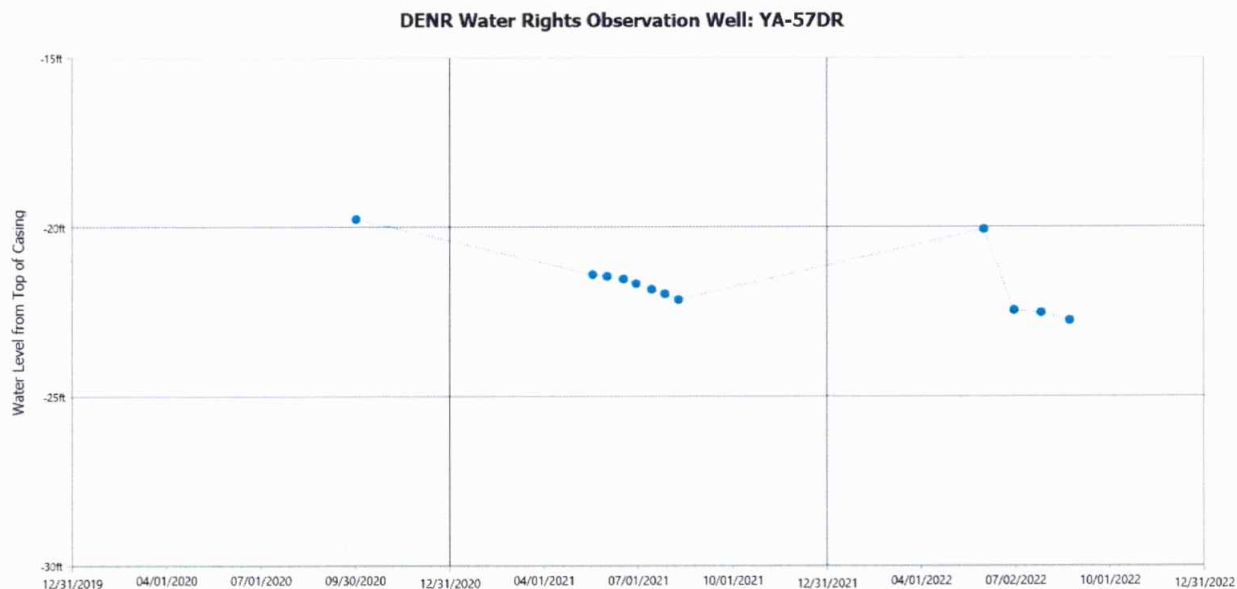


Figure 2. Hydrograph for observation well YA-57DR (Water Rights, 2022b)

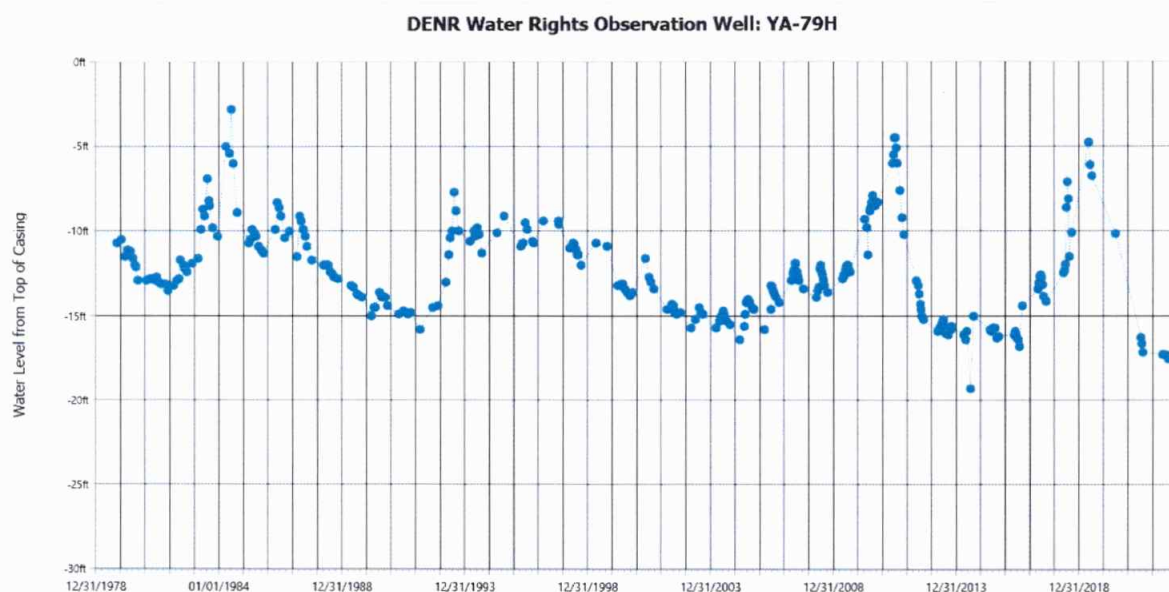


Figure 3. Hydrograph for observation well YA-79H (Water Rights, 2022b)

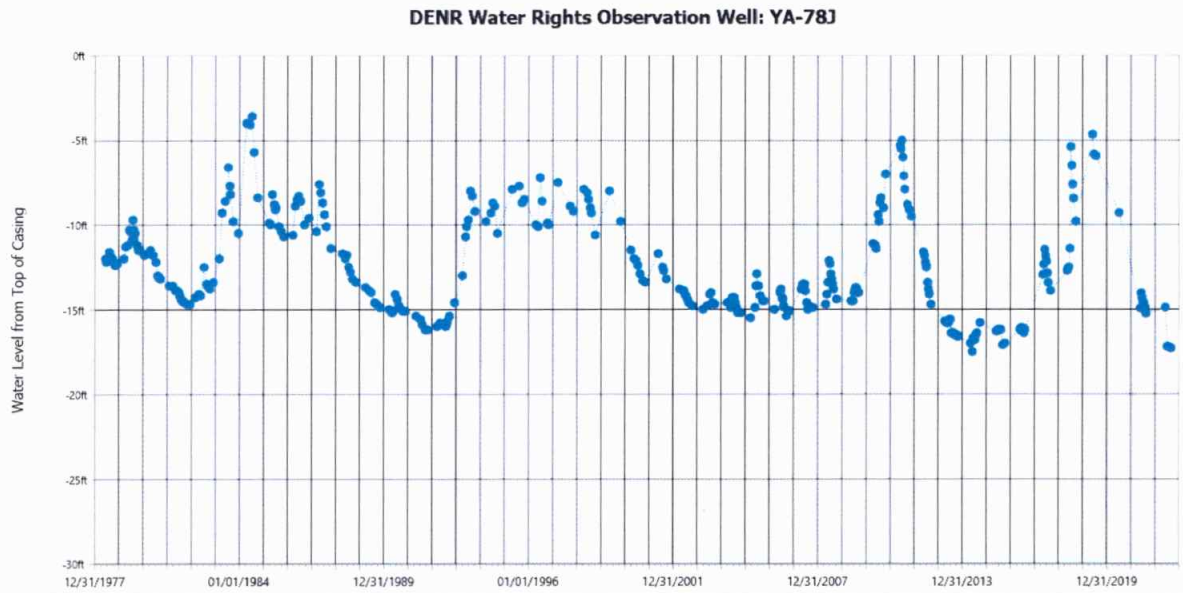


Figure 4. Hydrograph for observation well YA-78J (Water Rights, 2022b)

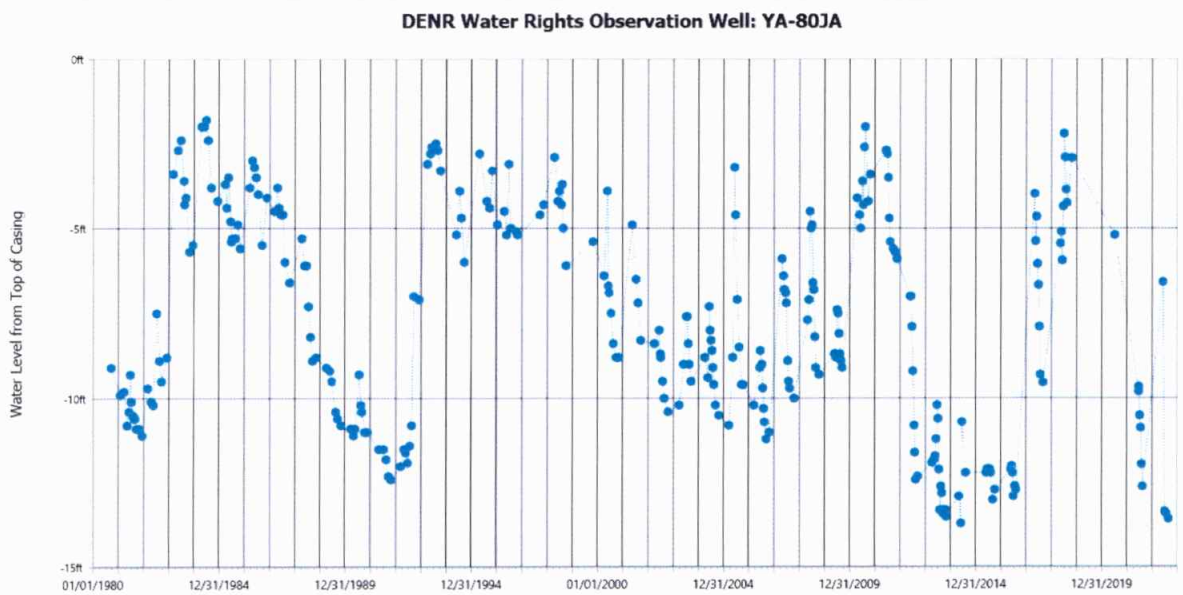


Figure 5. Hydrograph for observation well YA-80JA (Water Rights, 2022b)

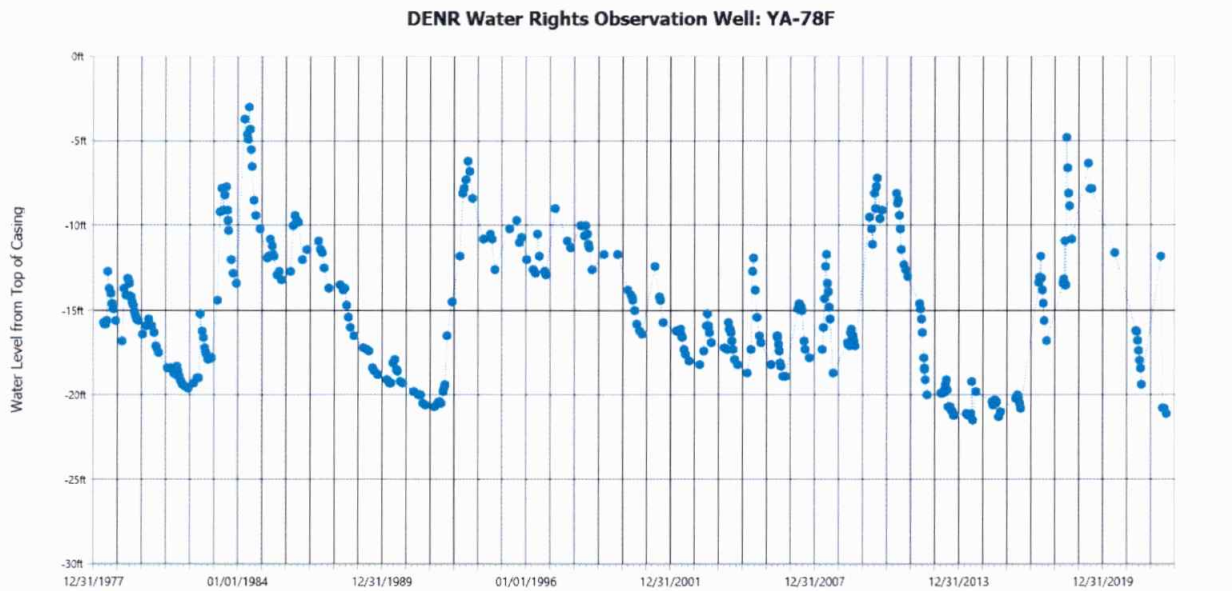


Figure 6. Hydrograph for observation well YA-78F (Water Rights, 2022b)

The United States Geological Survey (USGS) maintains Stream Gage #06467500, located on the Missouri River at Yankton, SD, and the hydrographs for this gage are shown in Figures 7 to 9 (USGS, 2022). By comparing the hydrographs for Stream Gage #06467500 to the observation well hydrographs of the Missouri: Elk Point aquifer (Figures 2 to 6), both show the river and aquifer react to climatic conditions by rising and falling over similar trends (USGS, 2022; Water Rights, 2022b). Additionally, during flood events (such as, the years 2011 and 2019), the water level in the Missouri: Elk Point aquifer, especially where in closer proximity to the Missouri River, rises very quickly beyond what is typically seen for glacial outwash aquifers (Water Rights, 2022b). This indicates there is a hydraulic connection between the Missouri: Elk Point aquifer and the Missouri River. Therefore, when the elevation of the water in the Missouri River is higher than the elevation of water in the aquifer, the river will recharge the aquifer. In contrast, when the elevation of water is higher in the Missouri: Elk Point aquifer, the aquifer naturally discharges to the Missouri River.

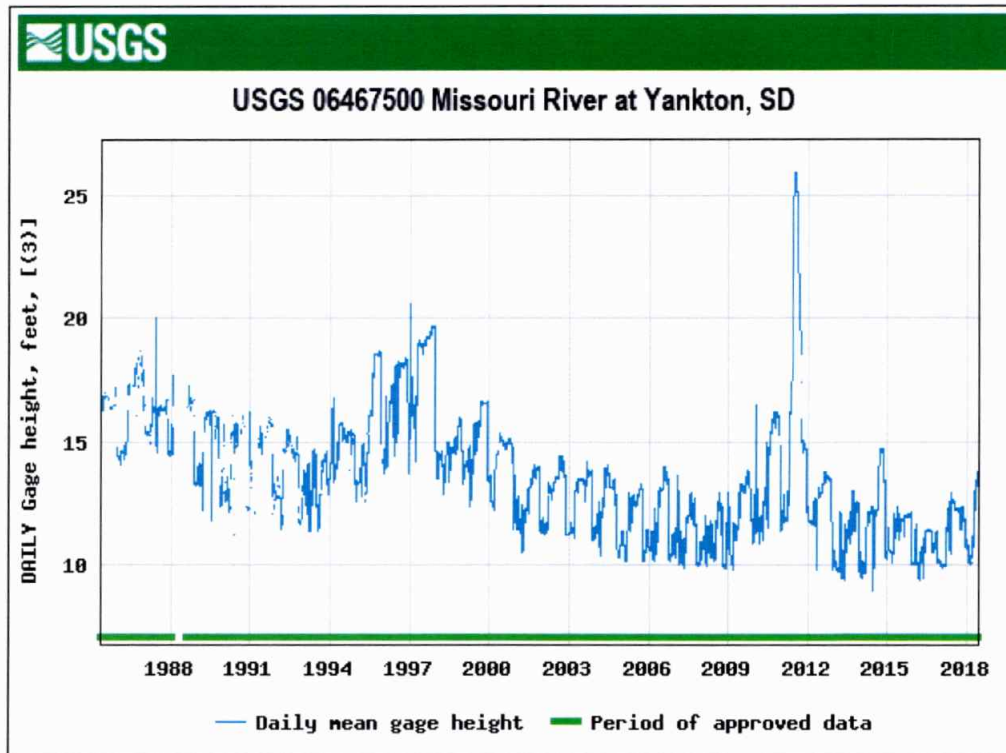


Figure 8. Hydrograph for USGS Stream Gage #06467500 Missouri River at Yankton, SD from 1985 to 2018 (USGS, 2022)

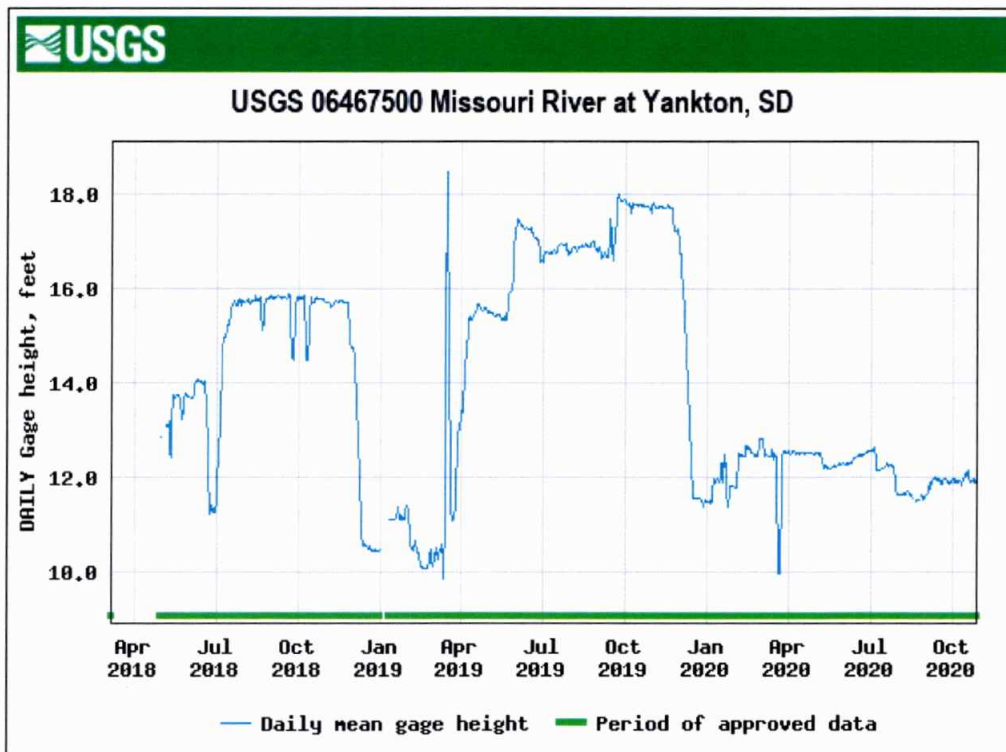


Figure 9. Hydrograph for USGS Stream Gage #06467500 Missouri River at Yankton, SD from 2018 to 2020 (USGS, 2022)

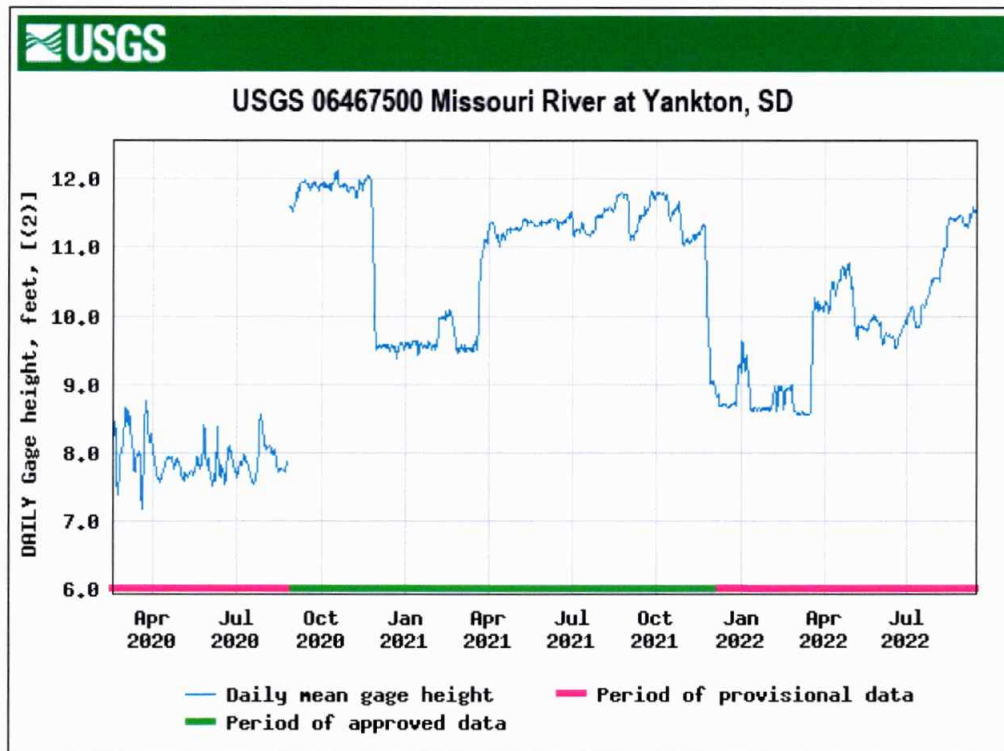


Figure 10. Hydrograph for USGS Stream Gage #06467500 Missouri River at Yankton, SD from 2020 to 2022 (USGS, 2022)

POTENTIAL FOR UNLAWFUL IMPAIRMENT OF EXISTING WATER RIGHTS:

Currently, there are 630 water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer, plus three pending applications – Water Permit Application Nos. 8614-3, 8656-3 and 8660-3 (Water Rights, 2022c). The closest water right/permit to the existing wells is Water Permit No. 7566-3, which is held by Daniel L Wallbaum Trust. The diversion point for Water Permit No. 7566-3 is located approximately 0.15 miles southeast of the nearest existing well proposed to be used for this application (Figure 10) (Table 6) (Water Rights, 2022c).

There are domestic wells on file with the DANR-Water Rights Program that are completed into the Missouri: Elk Point aquifer, with the closest domestic well on file (not held by the applicant) approximately 0.41 miles southeast of the nearest existing well proposed to be used for this application (Water Rights, 2022d). There could potentially be other domestic wells completed into the Missouri: Elk Point aquifer near the wells the applicant proposes to use that are not on file with the DANR-Water Rights Program.

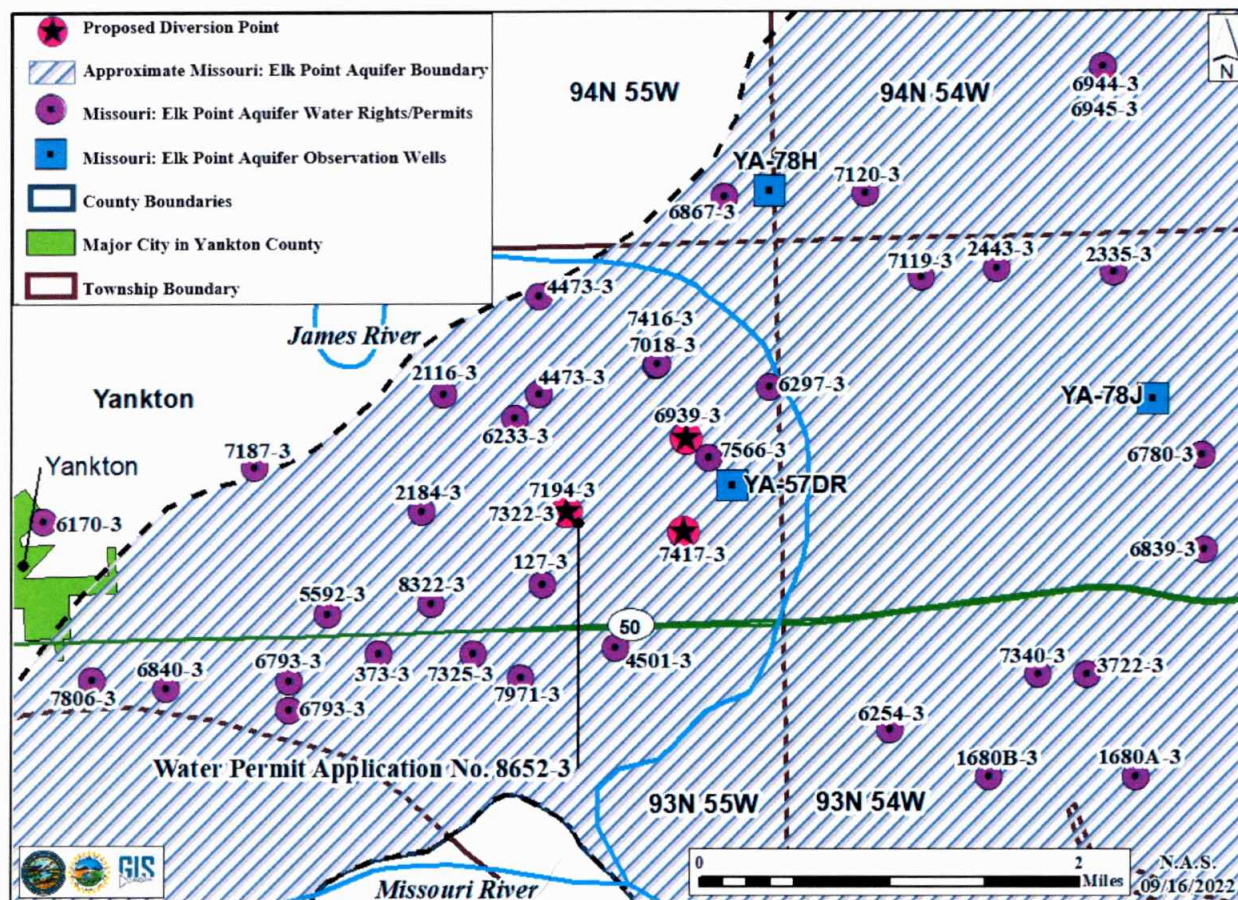


Figure 10. Location of the existing wells completed into the Missouri: Elk Point aquifer proposed to be used by Water Permit Application No. 8652-3, with the Missouri: Elk Point aquifer water rights/permits and observation wells within approximately three miles (Water Rights, 2022b and 2022c)

Table 6. Water rights/permits authorized to withdraw water from the Missouri: Elk Point aquifer within approximately three miles of the existing wells, as shown in Figure 10 (Water Rights, 2022c)

Permit No.	Name	Status	Use	Authorized Acres if IRR	Authorized Diversion Rate (cfs)
127-3	Prairie Creek Ranch LLC	LC	IRR	160	2.28
373-3	Redhawk LLC	LC	IRR	80	1.14
1680A-3	Heine Farms	LC	IRR	205.3	2.93
1680B-3	Heine Farms	LC	IRR	121.4	1.74
2116-3	Heine Farms	LC	IRR	132	1.9
2184-3	PJ Lyons	LC	IRR	224	2
2335-3	Wood Acres Inc	LC	IRR	80	1.11
2443-3	Marvin R Cook	LC	IRR	68	0.97
3722-3	Heine Farms	LC	IRR	230	2
4473-3	Jay Cutts	LC	IRR	247.1	2.68
4501-3	Eddie Wohl	LC	COM		0.05
5592-3	East Winds Court Inc	LC	SHD		0.11
6170-3	Knife River	LC	IND		0.222
6233-3	Dennis Kralicek	LC	IRR	76	1.45
6254-3	Heine Farms	LC	IRR	378	2.67
6297-3	J & J Farming Company LLC	LC	IRR	204	2
6780-3	Willard Schmidt	LC	IRR	115	1.64
6793-3	Eagle Venture	LC	IRR	247	2.89
6839-3	Karl M Schenk	LC	IRR	118	1.89
6840-3	Ron & Angela Kneip	LC	IRR	67	1.25
6867-3	Jay Cutts	LC	IRR	207	2
6939-3	John G Yaggie	PE	IRR	198	2.22
6944-3	Raymon & Pamela Epp	LC	IRR	66	1.56
6945-3	Patricia J Larsen	LC	IRR	66	1.56
7018-3	J & J Farming Company LLC	LC	IRR	132	1.89
7119-3	Jay Cutts	LC	IRR	65	0.93
7120-3	Jay Cutts	LC	IRR	90	1.29
7187-3	Prairie Creek Ranch	LC	IRR	138	1.67
7194-3	John G Yaggie	PE	IRR	38	2.22
7322-3	Redhawk LLC	LC	IRR	37	
7325-3	Coulson Land Co	PE	IRR	24.1	1.33
7340-3	Heine Farms	LC	IRR	365	4.45
7416-3	John G Yaggie	LC	IRR	35	1.11
7417-3	John G Yaggie	PE	IRR	13	
7566-3	Daniel L Wallbaum Trust	LC	IRR	148	1.72
7806-3	C & C Hauling and Construction	LC	IRR	25	1.08
7971-3	Barry Van Osdel	LC	IRR	64	1.11
8322-3	Randy & Valerie Svendsen & Sons	LC	IRR	268	1.78
LC: Licensed Water Right; PE: Water Permit; COM: Commercial; IND: Industrial;					
IRR: Irrigation; SHD: Suburban Housing Development					

The Missouri: Elk Point aquifer ranges from confined to unconfined aquifer conditions, but is primarily under unconfined conditions (Niehus, 1994 and 1997). Based on the well completion reports on file for the existing wells proposed to be used, and the well competition reports and lithologic logs on file for nearby observation wells, the Missouri: Elk Point Aquifer is unconfined at the existing well sites (SDGS, 2022; Water Rights, 2022b and 2022d). Drawdown created by pumping a well generally does not extend far from the pumped well in an unconfined aquifer; however, in a confined aquifer, drawdown from pumping could extend a distance from the diversion point. The exact drawdown behavior of a well cannot be known without an aquifer performance test. Examination of the hydrographs for observation wells completed into the Missouri: Elk Point aquifer show no signs of being significantly impacted by drawdown caused by pumping, despite usually being located within a mile of several high-yield wells (assumed to be a well with an authorized diversion rate greater than 0.2 cfs) (Water Rights, 2022b and 2022c).

At the existing well sites, the Missouri: Elk Point aquifer has a saturated aquifer thickness of approximately 80 to 90 feet (Water Rights, 2022d). This would generally allow for enough thickness for a pump to be placed 20 feet below the top of the aquifer, which is required for the well to be considered adequate under ARSD 74:02:04:20(6). Any drawdown as a result of the proposed diversion for this application is not expected to unlawfully impair nearby adequate wells. In Clay, Union, and Yankton Counties, there are no substantiated complaints on file with the DANR-Water Rights Program regarding well interference for adequate wells completed into the Missouri: Elk Point aquifer (Water Rights, 2022e).

The Water Management Board recognizes that putting water to beneficial use requires a certain amount of drawdown to occur. The Board has developed rules to allow water to be placed to maximum beneficial use without the necessity of maintaining artesian head pressure for domestic use. The Water Management Board defined an “adversely impacted domestic well” in ARSD 74:02:04:20(7) as:

“A well in which the pump intake was set at least 20 feet below the top of the aquifer at the time of construction or, if the aquifer is less than 20 feet thick, is as near to the bottom of the aquifer as is practical and the water level of the aquifer has declined to a level that the pump will no longer deliver sufficient water for the well owner’s needs.”

The Water Management Board considered the delivery of water by artesian head pressure versus maximum beneficial use during the issuance of Water Right No. 2313-2 for Coca-Cola Bottling Company of the Black Hills. The Board adopted the Findings of Facts and Conclusions of Law that noted the reservation of artesian head pressure for delivery of water would be inconsistent with SDCL 46-1-4 which states, “general welfare requires that the water resources of the state be put to beneficial use to the fullest extent of which they are capable...” (Water Rights, 1995). Furthermore, the Water Management Board found if increased cost or decreased production as a result of impacts on artesian head pressure by legitimate users is to be considered as an unlawful impairment, it would also conflict with SDCL 46-1-4 (Water Rights, 1995). With that in mind, some existing well owners may need to install or lower pumps depending on the specific

characteristics of the Missouri: Elk Point aquifer at their location. However, when considering the statutes (SDCL 46-1-4 and 46-6-6.1), rules (ARSD 74:02:04:20(6) and (7)), the saturated thickness of the Missouri: Elk Point aquifer at the existing well sites, and the lack of well interference complaints from the Missouri: Elk Point aquifer in the area, any drawdown created from the proposed diversion is not expected to cause an unlawful impairment on existing water right/permit holders or domestic users with adequate wells. Additionally, the wells proposed to be used are existing wells that have been in place and are presumed to have been in use since roughly 2008 and 2010 without any reported well interference complaints on file with the DANR-Water Rights Program (Water Rights, 2022c, 2022d and 2022e). Any drawdown created from the proposed diversion is not expected to cause an unlawful impairment on existing water right/permit holders or domestic users with adequate wells. Therefore, there is a reasonable probability that any interference from the proposed appropriation will not impose unlawful impairments on existing users with adequate wells.


CONCLUSIONS:

1. Water Permit Application No. 8652-3 proposes to irrigate 14 acres. The applicant holds Water Permit Nos. 6939-3, 7194-3, and 7417-3 which collectively authorize a maximum instantaneous diversion rate of 4.44 cfs from two existing wells completed into the Missouri: Elk Point aquifer (110 feet deep) for the irrigation of 248 acres. A licensing investigation found the systems irrigating an additional 14 acres. The site of interest is located in Yankton County approximately two miles southwest of Mission Hill, SD.
2. If approved, Water Permit Application No. 8652-3 and Water Permit Nos. 6939-3, 7194-3, and 7417-3 will collectively authorize a maximum instantaneous diversion rate of 4.44 cfs from two existing wells completed into the Missouri: Elk Point aquifer (110 feet deep) for the irrigation of 262 acres to reflect the irrigation systems as developed.
3. Based on observation well data and the hydrologic budget, there is a reasonable probability that unappropriated water is available from the Missouri: Elk Point aquifer to supply the proposed appropriation.
4. There is a reasonable probability that the proposed diversion by Water Permit Application No. 8652-3 will not unlawfully impair adequate wells for existing water rights/permits and domestic users.



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